

villous on both sides; calyx one-half or less the length of the banner; legume villous, 4-ovuled, 1-2-seeded. Flowering in June and July.

Type. Beaver City, Beaver County, Utah, 1877, *E. Palmer 91* (isotype, N. Y. Bot. Gard.).

Distribution. South central Utah, 6000 to 7000 (?) feet elevation.

Representative material. Deep Creek, June 6, 1891, *M. E. Jones*; Ibapah, June 22, 1891, *M. E. Jones*.

A number of collections show characters intermediate between the varieties *Piperi* and *Cusickii*, from which this variety is distinguished mainly by the possession of broad, always villous leaflets. The range of the available specimens is so far removed from those of the other varieties that I recognize the variety with less basis than usual. In some ways var. *villiferum* is intermediate between var. *Cusickii* and var. *Piperi*.

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## PINUS: THE FERTILE SPECIES HYBRID BETWEEN KNOBCONE AND MONTEREY PINES

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Fresh pollen collected from Monterey pine (*Pinus radiata* Don) growing a few feet above sea level near Monterey, California, was applied in April, 1927, to receptive conelets of the Sierra foothill form of knobcone pine (*Pinus attenuata* Lemmon) growing at an altitude of 3000 feet near Placerville, California, by Messrs. J. S. Barnes and W. C. Cumming of the Institute of Forest Genetics (then known as the Eddy Tree Breeding Station). The hand-pollinated cones were harvested in the autumn of 1928, and the hybrid seeds from these cones were sown in a seedbed the following spring. Twenty-eight two-year-old seedlings from this cross were planted in a block at 15 by 15-foot intervals in the Eddy Arboretum. Adjacent to them were planted a few seedlings of the two parent species.

In February, 1932, a cold wave swept the Sierra foothills. Minimum air temperatures at 16.4° F. at four feet above the ground and 15.4° F. at ground level were recorded at the Institute weather station. Seedlings of the knobcone pine were not injured by this temperature; some foliage of the hybrids was lightly frosted; and all the Monterey pine seedlings were either killed or permanently deformed. Absence of permanent injury to the hybrids, at a temperature that was ruinous to one of the parent species, stimulated interest in their subsequent behavior. Later, in January, 1937, when the trees withstood a temperature of 11.8° F., their resistance to cold was further emphasized.

When the hybrid trees were 16 years old, in April, 1945, they presented a relatively uniform appearance, although measurements revealed considerable difference in size between trees. The tallest tree was 61.7 feet, the shortest 42.0 feet, and the average was 52.3 feet. The tree of greatest girth was 19.3 inches in diameter at breast height, the smallest was 9.5 inches, and the average was 12.8 inches. Adjacent knobcone pines of the same age averaged 39.6 feet in height and 10.1 inches in diameter. Adjacent Monterey pines planted at the same time had been killed or so badly damaged by frost that measurements were meaningless; however, other Monterey pines that escaped the freeze in another part of the arboretum have shown a somewhat greater growth rate than that of the hybrid trees.

The  $F_1$  hybrid is more limby than Monterey pine but otherwise similar in general appearance. Because of its numerous, heavy branches, it is not recommended as a timber tree; it may prove to be a desirable ornamental tree, however, in localities that are slightly too cold for Monterey pine.

Some of the hybrid trees produced cones and catkins when they were four years old, and ten years all were bearing a dozen or more cones per tree annually. In 1940 seed from open-pollinated cones (mutual wind pollination between  $F_1$  hybrids) and seed of knobcone pine were planted in a seedbed. After five years the seedlings were compared. While there was much variation in individual growth rate, in general the  $F_2$  hybrids grew faster than knobcone pine seedlings. Although the  $F_1$  hybrid grew more slowly than Monterey pine, the growth rate of some individuals of the  $F_2$  population compares favorably with that of the best Monterey seedlings.

Because many of the  $F_2$  hybrids had not yet borne cones, the preliminary survey was limited to the distribution of needle characters. Of 73 seedlings examined, 76.6 per cent had fine or medium slender needles resembling those of Monterey pine, while 23.4 per cent had coarser needles much like those of knobcone pine. The needles of 21.9 per cent of the trees had the chalky-white stomata characteristic of knobcone pine, 28.7 per cent had translucent stomata similar to those of Monterey pine, and 49.4 per cent had stomata that were intermediate in character.

The character segregation (Table 1) is based on small numbers of specimens, and must be regarded with suspicion because possible disturbing factors are not yet known. However, the fertility of the  $F_1$  hybrid seed, the small percentage of abortive pollen, and the general segregation of other characters all suggest that the parents of this hybrid are closely related forms, at most ecospecies of the Turesson relationship concept, rather than distinct or remote species of the Linnaean concept. The natural crossing of these entities where their ranges impinge adds corroborative evidence to this concept of their relationship. Monte-

TABLE 1

Morphological characters that distinguish *Pinus attenuata* × *P. radiata*  
F<sub>1</sub> and F<sub>2</sub> from the parent species

Characters	<i>Pinus attenuata</i>	<i>Pinus radiata</i>	F <sub>1</sub> hybrid ( <i>P. attenuata</i> × <i>P. radiata</i> )	F <sub>2</sub> hybrid
Tree form	low, spreading, or erect	tall, excurrent	tall, excurrent	excurrent
Branching	profuse, ramified, irregular	less profuse, whorled	intermediate	segregation not known
Growth rate	moderate	rapid	rapid	rapid
Frost resistance	uninjured at 16° F.	killed or deformed at 16° F.	uninjured at 16° F.	not known
Bark	gray-green, late forming, trunk smooth	dark gray, early forming, trunk rough	intermediate	not known
Foliage color	gray-green	dark clear green	dark clear green	mostly dark green
Needle arrangement	in threes, sparse	in threes, abundant	in threes, abundant	in threes
Needle thickness	relatively coarse	slender, flexible	relatively slender or intermediate	23.4% coarse 76.6% fine or intermediate
Resin canals	usually two, sometimes more	two	two	two, occasionally absent
Stomata, color	glaucous, chalky white	translucent, not glaucous	all more or less chalky	21.9% chalky, others translucent or intermediate
Stomata, shape	sunken, margins flat	conic, margins raised	segregating, mostly intermediate	segregation approximately 37% sunken; 63% conic or intermediate
Cones, position	many on trunk, often embedded in the wood	few on trunk, seldom embedded	intermediate	not known
Cone scale, apophysis	yellow, carinate, narrowly tuberculate	brown, tumescent-tuberculate	brown, shape intermediate and variable	not known
Cone scale, spine	prominent, spine introrse	obscure, spine retrorse or absent	variable, introrse, retrorse, or obsolete	not known
Pollen	2% approximately abnormal	4% approximately abnormal	6-12% abnormal	not known

rey pine hybridizes naturally with the coastal form of knobcone pine near Swanton, Santa Cruz County, California.

The findings regarding this hybrid illustrate a considerable

and growing body of experimental evidence that challenges the accepted taxonomic placement of the recognized species of the genus *Pinus*. It is suspected that the commonly recognized species may, in many instances, conform closely to the subspecies of present-day thinking. One ancillary value of the pine breeding work being done at the Institute of Forest Genetics is the accumulation of experimental evidence that may contribute to a revision of the genus.

To record this hybrid form it is herewith described. The name proposed was chosen to show the derivation of the hybrid and to avoid the confusion that might follow the use of an orthodox name that gives no clue to the origin of the form described.

*Pinus attenuradiata* hybr. nov.

Arbor hybrida (*Pinus attenuata* × *P. radiata*), altitudo medio-cris, recta, pyramidata vel sub-rotunda, *Pinus radiata* similis; ramis numerosis, verticillatis, adscensis, apicibus diffusis; ramulis asperatis, squamis superioribus hyalinis; corte asperato, crasso, obscuro; gemmis terminalibus ovatis, acutis, 5–8 mm. longis, fuscis vel sub-rufis; foliis ternis, raro binis aut quaternis, circa 10 cm. longis, tenuibus, obscuro-viridibus; vaginis 10–15 mm. longis, adpressis, persistentibus, membranaceis, squamis pallidis aut sub-rufis, marginibus albidis, fimbriatis; canalibus resiniferis, medianis; iulis staminiferis ovato-cylindratis, 10 mm. longis; conis inaequalibus, ovatis, 2–5 verticillatis, sub-sessilibus, 8–15 cm. longis, 4–8 cm. crassis, squamis obscuro-fuscis, apophysis pyramidatis, tumidis; umbonibus planis aut elatis, spinis retrorsis, introrsis aut obsoletis; seminibus obovatis, truncatis, rugosis, 5 mm. longis, 3 mm. latis, 1.5 mm. crassis, testis coriaceis, nigris; alis oblongis, obliquis, obtusis.

Type. Eddy Arboretum, Placerville, Eldorado County, California, August 21, 1945, *Stockwell* and *Kimbrough 2012* (Herbarium of the University of California no. 694111; isotype, Dudley Herbarium, Stanford University, California).

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## A NEW ALPINE GLYCERIA FROM CALIFORNIA

ALAN A. BEETLE

The number of grass species confined to elevations of 9000 feet or higher in the Sierra Nevada of California is remarkably few. As reported to date they appear to be comprised of a pair